Remarks

In this discussion set forth below, Applicant does not acquiesce to any rejection or averment in this Office Action unless Applicant expressly indicates otherwise.

The non-final Office Action dated April 10, 2008, indicates that claim 4 recites patentable subject matter, but is objected to as being dependent upon a rejected base claim. The Office Action also lists the following rejections: claims 1, 2 and 7 stand rejected under 35 U.S.C. § 102(e) over the Chiu reference (U.S. Patent No. 7,078,351); claims 14 and 15 stand rejected under 35 U.S.C. § 102(e) over the Verhaverbeke reference (U.S. Patent No. 7,159,599); claims 3, 6, 8, 9 and 11 stand rejected under 35 U.S.C. § 103(a) over the Chiu reference in view of the Basi reference (U.S. Patent No. 4,116,714); claim 5 stands rejected under 35 U.S.C. § 103(a) over the Chiu reference in view of the Uzoh reference (U.S. Patent 6,235, 406); claim 10 stands rejected under 35 U.S.C. § 103(a) over the Chiu reference in view of the Mohindra reference (U.S. Patent No. 6,352,082); and claims 12 and 13 stand rejected under 35 U.S.C. § 103(a) over the Yun reference (U.S. Patent No. 6,635,582) in view of the Chiu reference. Applicant respectfully traverses each of these rejections.

The § 102(e) rejection of claims 1, 2 and 7 is improper because the Chiu reference does not teach all of the features recited in Applicant's claims. In particular, Chiu fails to disclose cleaning to remove residue after etching using a dilute solution of sulfuric acid in water, as claimed. The Chiu reference discloses that sulfuric acid and mixtures of sulfuric acid with hydrogen peroxide may be used to clean wafers, but does not disclose water-based sulfuric acid solution (*see, e.g.*, Col. 7:11-15). Chiu further fails to disclose using dilute sulfuric acid solutions, and instead discloses concentrated mixtures whose major component is sulfuric acid (*see, e.g.*, Col. 7:15-17). As is well understood to those of skill in the art, a dilute solution is one that contains a relatively small quantity of solute as compared with the amount of solvent (*see, e.g.*, http://chemistry.about.com/library/glossary/bldef52980.htm, which gives the following definition for 'dilute': "A solution containing a relatively small quantity of solute as compared with the amount of solvent. This term is the opposite of 'concentrated.'").

Applicant's invention distinguishes the claimed use of diluted solutions of sulfuric acid in water from known uses of concentrated sulfuric acid solutions, which have been

Applicant's invention distinguishes the claimed use of diluted solutions of sulfuric acid in water from known uses of concentrated sulfuric acid solutions, which have been observed to be non-corrosive due to the low water content (*see, e.g.*, paragraph 0007). Applicant observes that the claimed method is surprisingly effective for use on semiconductor substrates that include active devices and metal layers even though the water content of the dilute sulfuric acid solution is high. No such appreciation can be gleaned from Chiu's disclosure of non-aqueous, highly-concentrated sulfuric acid mixtures.

For at least these reasons, Applicant requests reconsideration and withdrawal of the § 102(e) rejection of claims 1, 2 and 7 over Chiu.

The § 102(e) rejection of claims 14 and 15 is improper because the Verhaverbeke reference does not teach all of the features recited in Applicant's claims. In particular, Verhaverbeke does not appear to disclose a mixing unit that mixes sulfuric acid from a reservoir and demineralized water to produce a cleaning agent, as claimed. Applicant is unable to find any teaching in the Verhaverbeke reference that concentrated sulfuric acid is mixed with water to form a cleaning agent. Instead, the portions of Verhaverbeke cited in the Office Action disclose that hydrofluoric acid and water are mixed (*see, e.g.*, Fig. 2A and corresponding discussions). It appears that Verhaverbeke's only disclosure of sulfuric acid for cleaning involves a mixture of sulfuric acid and hydrogen peroxide (*see, e.g.*, Col. 9:2-9), much like the Chiu reference. While the Verhaverbeke reference discloses a water rinse and dry step after the sulfuric acid cleaning step, Applicant finds no teaching or suggestion that water and sulfuric acid are mixed to form the cleaning solution.

For at least these reasons, Applicant requests reconsideration and withdrawal of the § 102(e) rejection of claims 14 and 15 over Verhaverbeke.

The § 103(a) rejection of claims 3, 6, 8, 9 and 11 is improper because the Basi reference fails to cure the deficiencies of Chiu as discussed above, and because there is no valid reason to make the proposed combination. The Basi reference relates to cleaning of freshly polished wafers to remove abrasive silica left over from polishing. As with the Chiu reference, Basi does not teach cleaning using dilute solutions of sulfuric acid in water. Furthermore, Applicant finds nothing in the Basi reference to suggest that

the disclosed cleaning steps would be suitable for cleaning an etched substrate that includes an active device and that may include metalized layers.

Moreover, Applicant submits that the Chiu and Basi references cannot be modified using the teachings of Basi because the primary Chiu reference teaches away from the proposed modifications. The Office Action admits that Chiu fails to teach heating the cleaning solution to temperatures in the range of 20 to 60° C., but argues that one of skill in the art would have modified Chui to use the 20 to 30° C. temperature range disclosed by Basi. Applicant observes, however, that Chiu does not merely fail to teach the claimed temperature range, but explicitly teaches using temperatures in the range of 100 to 150° C. As such, one of skill in the art would find no reason to modify Chiu in the proposed manner and against Chiu's explicit teachings.

For at least these reasons, Applicant submits that the proposed combination of Chiu and Basi is improper and does not teach or suggest Applicant's claimed invention. Therefore, Applicant requests reconsideration and withdrawal of the § 103(a) rejection of claims 3, 6, 8, 9 and 11.

The § 103(a) rejection of claim 5 is improper because the Uzoh reference fails to cure the deficiencies of Chiu as discussed above, and because there is no valid reason to make the proposed combination. The Uzoh reference, like the Basi reference discussed above, relates to using sulfuric acid solutions for pre-cleaning semiconductor wafers prior to any device formation. As such, Applicant submits that one of skill in the art would not reasonably expect that the disclosed cleaning steps would be suitable for cleaning an etched substrate that includes an active device. Moreover, the Office Action provides no explanation as to why the highly-concentrated sulfuric acid in hydrogen peroxide mixtures of Chiu would be replaced by the low concentration sulfuric acid in water solutions of Uzoh, particularly given Applicant's observations that high water content solutions would be expected to provide unsuitably corrosive results.

For at least these reasons, Applicant submits that the proposed combination of Chiu and Uzoh is improper and does not teach or suggest Applicant's claimed invention. Therefore, Applicant requests reconsideration and withdrawal of the § 103(a) rejection of claim 5.

The § 103(a) rejection of claim 10 is improper because the Mohindra reference fails to cure the deficiencies of Chiu as discussed above, and because there is no valid reason to make the proposed combination. The Mohindra reference discloses immersing silicon wafers in deionized water after oxide removal via hydrofluoric acid etching to thereby promote the formation of higher grade oxide. Applicant finds nothing in the Mohindra reference to teach or suggest cleaning using dilute sulfuric acid solutions in water, or to disclose any cleaning steps suitable subsequent to device formation and etching. For at least these reasons, Applicant submits that the proposed combination of Chiu and Mohindra is improper and does not teach or suggest Applicant's claimed invention. Therefore, Applicant requests reconsideration and withdrawal of the § 103(a) rejection of claim 10.

The § 103(a) rejection of claims 12 and 13 in view of Yun and Chiu is improper because the Yun and Chiu references share the same deficiencies, and thus cannot be combined to produce Applicant's claimed invention. The Office Action admits that Yun fails to disclose a cleaning agent containing a diluted solution of sulfuric acid in water. As noted above, Applicant submits that the Chiu reference also fails to disclose a cleaning agent containing a diluted solution of sulfuric acid in water. For at least these reasons, Applicant submits that the proposed combination of Yun and Chiu is improper and does not teach or suggest Applicant's claimed invention. Therefore, Applicant requests reconsideration and withdrawal of the § 103(a) rejection of claims 12 and 13.

In view of the remarks above, Applicant believes that each of the rejections has been overcome and the application is in condition for allowance. Should there be any remaining issues that could be readily addressed over the telephone, the Examiner is asked to contact the agent overseeing the application file, Peter Zawilski, of NXP Corporation at (408) 474-9063 (or the undersigned).

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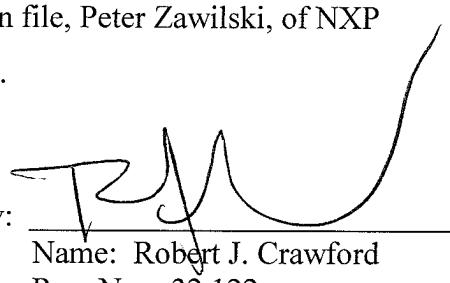
By: 

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